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ABSTRACT

This paper summarizes how mentalists have employed the concepts of recreating and restructuring to explain how children and adults acquire a second language and to show how the context of these terms is integrated within the content area of mathematics. The mentalist school of thought towards restructuring and recreating was divided into two camps: those who focus on grammar form and those who focus on semiotics or meaning. This paper compares how each camp of followers define and apply these concepts to design classroom acquisition contexts to facilitate content learning. Specific theories examined include those of Selinker (1972), and Dulay, Burt, and Krashen (1982). (Author/AIM)

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Running Head: DO LEARNERS RESTRUCTURE OR RECREATE

Do Learners Restructure or Recreate A Second Language in the Content Area of Mathematics?

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Abstract

This paper summarizes how mentalists have employed the concepts of recreating and restructuring to explain how children and adults acquire a second language, and then to show how the context of these terms is integrated within the content area of mathematics. The concept of recreating and restructuring are terms conceived by mentalists who use them differently to explain how children and/or adults acquire a second language (L2). In defining these terms in general, second language learners *recreate* a new language based upon individual hypothesis testing whereas in *restructuring*, they restructure the first language (L1) to approximate the second language (L2). Given that these terms are part and parcel of mentalist theory necessitated that they be examined within this school of thought's theoretical framework. The mentalists school of thought towards restructuring and recreating was subdivided into two camps: those who focus on grammar form and those who focus on semiotics (meaning). Selinker belongs to the former camp while Dulay, Burt, and Krashen (1982) constitute the latter. The objectives of this paper compared how each camp of followers define and apply these concepts to design classroom acquisition contexts to facilitate content learning. Selinker (1972) originally posited that adults engage in restructuring while children engage in recreating whereas Dulay et al. (1982) assert that children, and adults primarily engage in recreating to acquire an L2. Lenneberg (1984) and Selinker propose that internal learner factors and age of arrival of an L2 speaker prior/after puberty primarily distinguish how well children and adults pronounce an L2 while Dulay et al, state that while age may affect the L2 process, the learning setting's influence on the learner is more influential. Dulay et al. advocated a late-exit immersion sheltered content setting that focused on teaching students semiotics across content areas whereas Selinker's theory implies that L2 learners would be taught in an ESL grammar form-focused classroom setting to teach student content. Selinker's presumed emphasis on the rote-learning form in a lecture setting produces a decontextual content learning setting because it inhibits L2 students from learning how to connect the meaning of everyday words and content words with concrete referents and informal peer conversations which have been shown to be effective language aids..

Do Learners Restructure or Recreate A Second Language in the Content Area of Mathematics?

The purpose of this paper is to summarize how mentalists have employed the concepts of recreating and restructuring to explain how children and adults acquire a second language, and then to show how the context of these terms is integrated within the content area of math. The concept of recreating and restructuring are terms conceived by mentalists who use them differently to explain how children and/or adults acquire a second language (L2). In defining these terms in general, second language learners *recreate* a new language based upon individual hypothesis testing whereas in *restructuring*, they restructure the first language (L1) to approximate the second language (L2). Given that these terms are part and parcel of mentalist theory necessitates that they be examined within this school of thought's theoretical framework.

In the mentalists' framework, many of the findings revolve around their view that L2 learners acquire knowledge of an L2 in a fixed order that is processed internally. Mentalists use Selinker's (1972) concept of interlanguage to explain this phenomenon. Interlanguage is defined as the systematic knowledge of language that is independent of both the L1 and the L2 system one is learning. Mentalists state that internal factors, such as input and psychological factors, influence the learner's L2 acquisition process. Although mentalists agree that internal factors influence this process, there is disparity among them as to which ones do and to what extent they do. There are also differences on how they conceptualize this process, and define these concepts. The mentalists school of thought towards restructuring and recreating can be subdivided into two camps: those who focus on grammar form and those who focus on semiotics

(meaning). Selinker belongs to the former camp while Dulay, Burt, and Krashen (1982) constitute the latter. The objectives of this paper are to compare how each camp of followers define and apply these concepts to design classroom-acquisition contexts to facilitate content learning.

Context of Limitations

Selinker (1972) devised a theoretical framework that has not been applied to praxis. Although he did not apply it to the classroom, I believe that his theory's application to reality, like most linguistic theories, can be inferred. I demonstrate this application by applying it to my observations of a teacher and her students in a bilingual-mathematics classroom (Jaramillo, 1996b).

Restructuring

Selinker (1972) proposed that only adults engaged in restructuring to learn a second language. He asserted that most learners who begin to acquire an L2 after puberty never completely reach their target language because (1) they employ their latent psychological structure rather than the latent language structure; (2) their language acquisition device (LAD) atrophies after puberty; and (3) they experience *fossilization*, and *backsliding*.

According to Selinker (1972), most adult L2 learners (approximately 95%) do not fully acquire their L2 because they do not employ their latent language structure's five cognitive processes which are contingent upon their LAD's operationality which atrophies during the onset of puberty (i.e., ages 12-15). Instead, these learners rely on their latent psychological structure's processes which do not promote L2 acquisition. To the extent they ineffectively use these five cognitive interlanguage (IL) processes, the more unlikely they are to reach their target language.

For instance, these learners do not acquire L2 during the first process of language transfer when they do not transfer the L1's structure to the L2's structure This is apparent when native Spanish speakers who are learning English say, "I have twenty years rather than I am twenty years old." They are also destined not to produce the TL when they use "non-natural strategies," such as a foreign language dictionary. L2 learners will likewise not reach target language (TL) fluency if they engage in ineffective strategies of communication, such as when they frequently produce verbal errors, seldomly speak, or speak only the correct form of the target language. In addition to these barriers of Second Language Acquisition (SLA), L2 learners are also inhibited by *fossilization*.

Selinker (1972) says L2 learners commit *fossilization* when they do not attain target language (TL) competence because they do not reach the apex of their interlanguage's spectrum. That is, "they stop learning when their interlanguage contains at least some rules different from those of the target language system" (Ellis, 1985, p. 48). L2 learners produce fossilization errors when they do not match an interlanguage form with a target language one, such as the French uvular /r/ in English interlanguage. Once L2 learners fossilize, they can never fully develop their TL. Those L2 learners who fossilize also engage in *backsliding*. L2 learners commit backsliding when they fossilize, then experience some target language growth, and then ultimately experience a decline in their TL. L2 learners backslide when they focus on meaning; particularly when the content is difficult, they will backslide towards their interlanguage norm. Selinker says fossilization is explained through internal and external causes. This internal cause is evident when L2 learners believe they do not need to advance in their interlanguage while the external

cause is evident when the learners' neural structure's growth halts, thereby inhibiting hypothesis testing. Thus far, Selinker has employed biologically determined factors and internal processes to explain SLA; however, he has largely underplayed how "affect" influences SLA.

Unlike Dulay, Burt, and Krashen (1982) who stress the importance of how psychological factors influence the L2 process, Selinker (1972) underplays how psychological factors, such as "culture shock," influence SLA which immigrant L2 learners experience. Although many Euroamerican L2 learners believe that affective factors, such as individual effort (i.e., will power) will motivate them to excel beyond fossilization and backsliding, Selinker says they will not advance. Moreover, he would assert that no matter how much adult learners desire to acquire an L2, their efforts will be circumvented by the inevitable processes of fossilization and backsliding, because they cannot activate their latent language structure.

In order to ameliorate adult-student errors in L2 acquisition, proponents of restructuring advocate that the learning context of the classroom should focus on the form (output) that students exhibit (utter or write) while learning a content area, such as English as a second language (ESL) mathematics. This type of classroom learning-context would be comparable to a formal drills-based approach where the teacher believes that drilling students in the rules of formal grammar will advance their skills in reading, listening, speaking, and writing. Form in an ESL math setting is exemplified when the teacher utters to first generation Mexican students to spell a word, such as the quadrilateral shape of a "kite." Upon seeing in their written work that they spell it as "qite," the teacher exclaims, "You misspelled it," and then writes it on the

chalkboard while saying please spell it as K I T E. Preoccupation with the English word's form prevents the teacher from realizing that these students originally learned how to pronounce and write in Spanish which sometimes does not have sounds that are produced in English. For instance, these students rarely used the "K" sound in Spanish and thus when they heard it, they employed the "Q" sound which is the next approximate sound equivalent in Spanish.

This classroom is largely a physically context-reduced setting that features teacher-controlled discourse with a rote-form emphasis. In this context, the teacher stands and lectures while the students sit quietly at their individual desks. This would largely be a non-Basic Interdependence Communication Skills (BICS)-like behaviorist setting where the teacher utters commands to students, who either respond in unison by repeating the utterance or by simply listening. (In symmetry with behaviorist learning theory, advocates of this approach assert that what one learns is environmentally determined.) This is evident when a mathematics teacher who wants to teach a math solving-procedure consisting of steps, such as (1) Write the equation, (2) Substitute, (3) Simplify, and (4) Answer would utter this sequence to the students who would respond by repeating it aloud. Although students respond to the teacher's utterance, their rote-learning response indicates that this is a restricted two-way communication system, one in which they would not speak openly to the teacher, who largely dictates what, when, and how they will study. (Emphasis on rote-learning form means the teacher largely does not use valuable multi-representational language aids such as manipulatives, pictographs, and ideographs to teach content areas.)

This type of teacher also employs the one-way communication technique to control what students do and say. In this classroom setting, the teacher lectures while students passively sit and listen. When the students are responding appropriately to commands, then the teacher can positively reinforce their behavior by rewarding them with praise or a material reward. For instance, if her goal was to shape their behavior to repeat her verbal language drills, she could reward them with a cupcake to induce them to continue to do this as a habit. (To some extent, this type of program's components are analogous to Cummins' Cognitive Academic Learning Proficiency (CALP) skills approach which likewise largely relies on pupil scores on standardized tests to place and assess student performance.) The restructuring perspective's focus on form, rote learning, restricted student-teacher discourse, and non-manipulative use has led many to criticize this approach's effectiveness towards L2 acquisition and content learning.

Furthermore, many constructivists and thematic holists would charge that the context of the restructuring perspective as a traditional teaching approach towards SLA does not effectively integrate with content learning. As a thematic holist, Dewey (1994) asserts that a traditional program setting tends to provide students with disconnected meaningless curricula content, because the students would complete ditto worksheet problems that do not demonstrate how content is connected to form and reality (see Appendix A). This is evident through this perspective's focus on teaching form, rather than on the meaning of what the form represents. For instance, when a traditional teacher provides students with a math ditto problem which states, "Find the product of 3 x 2," they are not provided with a realistic concrete context, such as three

columns of apples by two rows of apples, which is needed for making the connection between the meaning of this multiplication operation and its symbolic form. Constructivists, like Jonassen (1991), argue that teachers who use rote-learning drills, such as repeating lists of words, are not teaching students how to think but merely to mimic. Dulay, Burt, and Krashen (1982) note that traditional teachers tend not to foster the discourse with their students that is needed to convey a second language and content area to them.

Moreover, in Selinker's (1972) mentalists' framework, many of his dubious findings revolve around his view that learners acquire a knowledge of an L2 in a fixed order that is processed internally. Mentalists use Selinker's concept of interlanguage to explain this phenomenon. Hence, the mentalists' claim that L2 learners internally process this interlanguage and follow a fixed universal route, yet this explanation is refuted by critics. For instance, Ellis (1985) says that ". . . although learner-internal factors are powerful determinants of SLA, the conviction that they are capable of accounting for the entire process, . . . is not warranted" (p. 42). These internal factors discount the role of external environmental factors and largely discount the role of socio-linguistic interaction and psychological factors. Firstly, although the behaviorists' explanation states that humans solely rely on conditioning to acquire an L2 was largely disproven, there are external stimuli and positive reinforcement techniques, such as when an L2 teacher uses a comforting tone or hugs an L2 learner to elicit the correct response, that influence SLA. Secondly, according to Schumann (1978), humans acquire an L2 in social-linguistic environments where they "verbally" communicate their intentions (i.e., output) to obtain their needs and

wants, rather than solely demonstrating Krashen's (1985) notion of comprehensible input process.

Moreover, Selinker's (1972) concept of interlanguage is a simplistic mental fabrication that rests on three questionable assumptions which, in turn, exhibit unanswered questions. Firstly, Selinker says that interlanguage is always distinct from the native language; however, this assumption cannot be empirically corroborated, because this mentalist fabrication is unmeasurable. Secondly, Selinker posits that an interlanguage will develop as long as one receives input in the target language, yet he neglects to say to what extent an L2 learner needs to receive input, how often it is needed, and what is understood about the L2. Thirdly, Selinker states that those interlanguage learners (IL) who have similar contact with their L2 will all develop the same level of interlanguage; however, he fails to account for individual learning pace differences and paradoxically appeals to behaviorism rather than mentalism, because this assumption is based on one's language experience. As a whole, Selinker's version of the interlanguage model is a simplistic one that does not adequately explain the L1=L2 hypothesis' age factor dilemma.

Recreating

In contrast to Selinker's (1972) emphasis on teaching grammar form in L2 acquisition, Dulay, Burt, and Krashen (1982) focus on the semiotics (meaning), hypothesis testing, and natural learning setting that the teacher and students interact in during L2 discourse. Dulay et al. use the term "linguistic creativity" which is synonymous in meaning with the term "recreating." They assert that linguistic creativity is exemplified among speakers who regularly produce and understand sentences they have

never heard before. This ability was evident in the discourse between the teacher and high school bilingual math students I have been observing. In this discourse, the teacher taught a series of algorithmic steps to students who applied them to a novel problem and produced a novel string of English sentences (steps). Given the students' knowledge of the algorithm steps: Write the problem [WTP], (2) Simplify [S], (3) Variable on the left [VOL], (4) Numbers on the right [NOR], and (5) Solve [S]; the teacher draws the following problem: I-9I + Z = -5 on a marker board while asking students to solve it and to read their response aloud. One student responded with the following novel sentences to this problem: "Simplify, change the negative nine I-9I to a I9I [S]." After uttering this, the student looked toward the teacher for feedback as to whether the math step or L2 hypothesis made mathematical sense in the English language. The teacher responded, "Yes" which verified the student's hypothesis and understanding of this subject matter's content and L2. When students create novel syntax it can be said that they reinvent knowledge.

A type of hypothesis testing is also evident among second language learners (L2) of English who engage in *overgeneralizing*. This is often demonstrated when learners extend the present tense of a sentence such as, "He runs" to create the past tense of "He runned." Rather than overcorrecting the students' verb-tense form, Dulay et al. (1982) recommend that the teacher simply explain that this is an irregular-past tense English verb and then use the word in a sentence such as, "He ran home," to provide the student with linguistic context. In another syntax example, children test hypotheses when an L2 student says "I goed to my grandparents" rather than "I went to my grandparents." A teacher of the grammar-form approach would designate syntax examples like this as an

error and immediately overcorrect the student without realizing that this sentence shows comprehension; namely, the application for the general rule of how to mark the past tense in English. A teacher of the recreating approach would recognize that a student explores his understanding of an L2 by inventing novel sentences in the guise of hypothesis tests.

To teach students content, Dulay, Burt and Krashen (1982) advocate a natural communication setting that is equivalent to a late-exit immersion approach with sheltered second language (L2). In immersion education, children are taught a second language through content teaching in that language while being exposed to contextual clues and lessons geared to the students' respective level of competence (Crawford, 1991). In the late exit immersion model students receive communication-based ESL and sheltered English classes. Dulay et al.'s advocation of this approach is based on the following assumptions: (1) the first language (L1) is largely learned separately than the L2, (2) children as well as adults tend to recreate more than restructure an L2, and (3) children tend to explore more than adults because they are less preoccupied with their performance.

When one learns language, one is learning (Halliday, 1993). I believe that learning a language is integrated within learning a content area. For instance, when ones learns a second language, it naturally applies toward learning a content area in that language. When L2 students respond to an ESL teacher's math question in English, they are employing their competent performance of English syntax and English math jargon. This is evident when a teacher states, "What is the formula for area? and the student responds, "Area equals length times width [A=LxW]." In this way, a content area, such as math, is exemplified as an extension of language.

(Moreover, some, like Santos (1991) refer to content areas as a register.) Language and content area are intertwined and therefore can rarely (if at all) be separated. To do so, is to decontextualize the inherent existence of a content area within language. Learning a content area in a second language is particularly important because researchers, such as Castellanos (1980), Jaramillo (1996a), Santos (1991), and Secada (1990) have cited how notations and algorithms in the math content area vary cross-culturally. This further attests to the connection between the context of language and the context of a content area. Proponents of a recreating approach, such as Faltis and Merino (1992), Faltis (1993), and Tickunoff (1983), recognize this connection and recommend employing a classroom setting that foster this connection for L2 learners.

To foster a recreating setting that produces a connection between a student's L2 and a content area, such as mathematics, Dulay et al. (1982) posit that teacher should allow for a learner silent period, employ comprehensible input, sheltered English, and contextual clues that prompt natural acquisition of a subject matter. Dulay et al. say the learning setting of the student and teacher should consist of one-way communication, restricted two-way communication, and full two-way communication.

Since many L2 student learners experience a silent period before they begin to recreate English speech, Krashen (1981) and Dulay et al. (1982) assert that the ESL teacher must initially use one-way communication to facilitate the natural order of the acquisition process. This is exemplified among some immigrant Mexican children who do not speak English for several months while in the United States. During this period, they are developing competence through input-listening, and "only"

when ready to do so, will they speak. This period also occurs among adults, albeit it is different. Adults tend to speak before they have acquired the language because they are usually taught by teachers who stress grammar drills. They compensate for this unnatural learning by mentally producing the desired sentence in the first language and then by adding the words of the target language's vocabulary. Adults, more so than children, use their monitor (part of the learner's internal system that employs conscious linguistic processing) to note the grammatical difference between L1 and L2 and to produce the appropriate L2 response.

After learners complete their silent period, Dulay et al. (1982) assert that the teacher needs to use restricted two-way communication to foster L2 acquisition among students. In restricted two-way communication, the learner responds orally to someone, but the learner does not use the target language (Dulay et al, 1982). To facilitate a student's input toward this communication, teachers should maximize the students' exposure to natural communication by devising questions for them that focus on message rather than form. For instance, posing an open-ended realistic math question, such as "Besides this door, are there any rectangular objects in the classroom?" [while pointing to a concrete referent like a classroom door], provides students with physical context to associate the word "rectangle" with. The use of extralinguistic factors, such as concrete referents, assist the learner to comprehend the meaning of the strange sounds of the new language. For instance, in Spanish each vowel letter correlates with a specific sound (phone) [the short "a" in "al"] whereas in English, a vowel can have more than one sound [the "a" can be short "a", long "a", or um laut ä] (Fromkin & Rodman, 1983). Transitioning from the largely phonetically-based Spanish to English

requires the student to memorize many non-phonetic letters within English words, such as "high".[1] To encourage students to respond with fuller sentences, teachers should ask questions that thematically connect with their formerly produced ones. In following up the question posited earlier, a teacher should ask, "What types of rectangles do you have in your house?" Thus far, the teacher has employed a restricted two-way communication setting that featured initiating the discourse, but this setting should advance to full two-way communication.

In full two-way communication, the learner speaks the target language and performs (recreates) as both recipient and sender of verbal messages. This is the type of communication that facilitates active learning and recreating in the target language. This setting fosters informal discourse between student and teacher thereby placing the learner in a natural situation where he/she must rely on understanding the L2 messages via listening to discourse and sensing contextual cues. To facilitate rapport for an L2 learner in math, the teacher can employ the "here-and-now" principle which involves describing what the students do, what has just happened, or ask about their ongoing activities (Dulay et al., 1982). For instance, an ESL math teacher who upon repeatedly reviewing a Mexican student's math problem, such as solving the equation 2 (3 + 5) on the marker board, observes that the student routinely solve it differently than the American way, exclaims, "Where did you learn how to solve it that way?"

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[1] The many non-phonetically based words inherent within English were recognized by George Bernard Shaw during the 1900s who sought to alter the English language to conform to a phonetically-based alphabet (Fromkin & Rodman, 1983).

According to Perkins (1994), Americans use the following steps: [1] 2 (3 + 5), [2] 2 (8), [3]=16 to solve a distributive equation whereas some Mexican students use the following steps: [1] 2 (3 + 5), [2] 6 + 10, [3] =16. The differences between languages as well as math notations and algorithms for Mexican students doing English mathematics requires that teachers show examples that demonstrate how language and content areas such as mathematics must be understood within the context of one's cultural-schooling tradition (Jaramillo, 1996a). They can show these contextual differences by drawing each respective culture's schooling version of a math problem on a marker board under the column headings of United States and Mexico, and explaining to them that each one is equally valid. In general, teacher-to-peer communication will not be the norm in this setting. Instead, peer communication will be the more employed communication pattern because studies indicate that students learn in the dialect of their peers and that they prefer to associate with their peers (Dulay et al., 1982). Ultimately, the goal of this type of communication is to produce a low-anxiety environment for the ESL student by lowering the affective filter or the complex of psychological factors that often obstructs the learner's comprehensible input (Crawford, 1991).

In conclusion, Selinker (1972) originally posited that adults engage in restructuring while children engage in recreating whereas Dulay et al. (1982) assert that children and adults primarily engage in recreating to acquire an L2. Lenneberg (1984) and Selinker propose that internal learner factors and age of arrival of an L2 speaker prior/after puberty primarily distinguish how well children and adults pronounce an L2 while Dulay et al, state that while age may affect the L2 process, the learning setting's influence on the learner in conjunction is more influential. Dulay et al.

advocated a late-exit immersion sheltered content setting that focused on teaching students semiotics across content areas whereas Selinker's theory implies that L2 learners should be taught in an ESL grammar form-focused classroom setting to teach student content. Selinker's emphasis on the rote-learning form in a lecture setting produces a decontextual content learning setting because it inhibits L2 students from learning how to connect the meaning of everyday words and content words with concrete referents and informal peer conversations which have been shown to be effective language aids. As products of an approach that emphasizes memorization of form through drilling exercises, these students often became good mimics rather than effective learners. In contrast to this behaviorist-like approach, Dulay et al,'s emphasis on using content areas that are inseparable from language is effective because it shows students how to apply their learning of a L2 to a content area. Simultaneously employing hypothesis testing in an L2 and content area facilitates the students' internalization of grammar and vocabulary. This approach enables them to assess their performance on an ongoing basis in a communication-based setting that fosters understanding a message via listening and speaking over reading and writing. Allowing for a learner's silent period and employing comprehensible input, sheltered English, and contextual clues prompt natural acquisition of a subject matter.

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